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The
Florida Entomologist

Official Organ of the Florida Entomological Society

VOL. XXVII JULY, 1944 No. 2

TWO NEW APHIDS FROM RHODODENDRON AND RELATED PLANTS

(Homoptera: Aphididae)

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In August 1941, the writers spent a short vacation in the mountains of western North Carolina and while there, devoted some time to the collecting of aphids. An *Amphorophora* was taken on rhododendron, mountain laurel, and wild azalea, which seemed somewhat similar to a species of this genus previously taken on the wild azalea in Florida. Shortly after returning home, the junior author took what appeared to be the same species on rhododendron in Pennsylvania, and the following year he collected the aphid on rhododendron, mountain laurel, and wild azalea. Specimens of the North Carolina aphids were submitted to P. W. Mason, who stated that they belonged to a species which he had seen before, but which was undescribed. Through correspondence, it was learned that Clyde F. Smith of the North Carolina Experiment Station, had on several occasions taken an *Amphorophroa* on rhododendron and related plants, and a few slides of the aphids from Pennsylvania and Tennessee were found in other collections. Although these aphids all appeared to be alike, it was not known whether all were the same species, or if more than one species was involved. The writers, therefore, decided to make detailed studies of all available material, in an attempt to settle this point. As a result of these studies we have reached the conclusion that there is one variable species which extends from north-central Florida, through North Carolina and into Pennsylvania. Further col-

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Published August 5, 1944

lecting may show that its range is co-extensive with the range of its host plants. In addition to this widely distributed species, a second species was discovered in a collection of aphids taken on mountain laurel in Pennsylvania. This proved different from any known species of *Amphorophora*.

We wish to express our appreciation of the helpful advice of Dr. P. W. Mason of the Bureau of Entomology and Plant Quarantine, who has also made available for study, specimens of the aphid from the national museum collection. We are also grateful to Dr. Clyde F. Smith of the North Carolina Experiment Station, who permitted us to use and study his numerous slides of the aphid and who has given information concerning its biology and appearance.

AMPHOROPHORA RHOKALAZA new species
Alate Viviparous Female Figs. 1, 3, 6, and 8

COLOR.—Living aphids from the wild azalea in Florida were principally used in obtaining these color notes though these have been supplemented by observations made elsewhere. The body is predominantly light yellowish-brown and the appendages vary from dark brown to a deep shining black. In some specimens, the body shows a faint greenish tinge. Head, thorax, and abdomen usually nearly concolorous, but the head and the posterior portion of the abdomen sometimes more yellowish than the other parts. Eyes, reddish brown with dark brown ocular tubercles; ocelli bordered with dark brown rings. Antennal tubercles dusky brown. Antennae with first two segments medium brown, the remaining segments dark brown to deep black. In some individuals a very small basal portion of segment III is yellowish. Rostrum light brown with apical portion dark brown to black. Dorsal thoracic lobes slightly darker than rest of thorax. Wings hyaline, stigma greyish-brown, subcosta yellowish-brown, remaining veins light brown, the anal and cubital veins bordered with dark brown shading. Femora of all legs yellow at the base, middle portion light brown, apical portion black. Tibiae usually entirely black, the middle portion sometimes dark brown; tarsi dark brown or black. Cornicles black, the extreme base sometimes yellowish brown. Cauda and anal plate yellowish, the cauda often dusky toward the apex. Some individuals have a row of dark reddish-brown spots along each side of the abdomen and an area of similar color

around the base of each cornicle. Immature aphids with a pulverulent coating which gives them an ashy or silvery appearance, this condition sometimes persisting in adult apterae.

HEAD AND APPENDAGES.—Antennal tubercles of moderate size, strongly diverging. Ocelli rather large, eyes with prominent ocular tubercles. A pair of slightly raised, rounded tubercles usually present on the basal half of the dorsum of head. These vary greatly in size and in some individuals appear to be lacking. Antennae one-third to one-half longer than the body, strongly curved, bent backward and elevated over the body when insect is at rest. Beak extending nearly to hind coxae. Head and its appendages with rather prominent, thick spines, those on front of head and basal antennal segments often definitely capitate or spatulate. Considerable variation is noted in the length and prominence of these spines in different individuals from each of the localities where the aphid has been taken. Third antennal segment feebly imbricated toward the apex, remaining segments with rather strong imbrications. Segment III with 22-41 large, subcircular, slightly raised sensoria, irregularly scattered over one side and extending nearly its full length.

THORAX AND APPENDAGES.—Florida speciments with lateral prothoracic tubercles small and inconspicuous, sometimes apparently entirely lacking; mesothorax with a prominent multiple tubercle on each side of the anterior margin. In North Carolina and Pennsylvania specimens, the prothoracic tubercles generally are better developed, the mesothoracic ones less so. Legs of moderate length, armed with rather prominent reclining spines, those on basal part of the tibiae sometimes somewhat capitate or spatulate.

ABDOMEN AND APPENDAGES.—Dorsum of abdomen rather sparsely armed with pointed spines which are somewhat less heavy than those on the head and appendages. Cornicles averaging slightly shorter than antennal III, moderately swollen, the apical portion sharply constricted; rather feebly imbricated, the constricted apical portion with definite, coarse reticulations. In some individuals a small pointed spine is found on the swollen part of the cornicle. Cauda less than half as long as the cornicles, slightly constricted near the middle, rather strongly imbricated, with three pairs of slightly curved lateral hairs and a single subapical, dorsal hair. Lateral abdominal tubercles inconspicuous, sometimes apparently entirely absent. In well-

cleared specimens, two rows of segmentally arranged wax pores are visible on each side of the dorsum of the abdomen.

MEASUREMENTS.—Careful measurements were made of various body parts of ten alate females from each of the three states where the aphid has been much collected. These measurements (all measurements given in this paper are mm.) are summarized in the following tables:

Antennal Measurements (Average of ten individuals)

Locality	III	Sensoria on III	IV	V	VI
Florida	.844	26.5	.556	.497	.136 + .893
North Carolina	.942	31.8	.759	.624	.172 + 1.058
Pennsylvania	.866	30.1	.679	.610	.165 + 1.046

Other Measurements (Average of ten individuals)

Locality	Width of head	Cornicle			Length of cauda	Hind tibia
		Length	Width at bulge	Width of reticulated area		
Florida	.479	.697	.077	.041	.281	1.815
North Carolina	.517	.862	.092	.048	.366	2.235
Pennsylvania	.490	.793	.082	.047	.348	2.017

Antennal Measurements (Range in ten individuals)

Locality	III	Sensoria on III	IV	V	VI
Florida	.799– .911	22–30	.488–.622	.444–.533	.135–.155 + .844–1.022
North Carolina	.866–1.000	28–41	.688–.866	.555–.688	.155–.188 + .977–1.199
Pennsylvania	.733– .933	27–37	.577–.777	.511–.688	.155–.177 + .955–1.177

Other Measurements (Range in ten individuals)

Locality	Width of head	Cornicle			Length of cauda	Hind tibia
		Length	Width at bulge	Width of reticulated area		
Florida	.444–.488	.622–.755	.073–.085	.039–.046	.233–.311	1.688–1.955
North Carolina	.511–.533	.799–.955	.085–.106	.046–.053	.311–.422	2.111–2.422
Pennsylvania	.488–.511	.733–.866	.086–.099	.046–.053	.311–.377	1.822–2.177

Apterous Viviparous Female — Figs. 2, 4, 5, 7, 9, 10, 11, and 12.

COLOR.—Coloration in this form much as in the alate female, the first two antennal segments somewhat lighter brown, and more light brown on the legs, than in the alate. The pulverulent coating sometimes persists to the adult stage in this form, giving some individuals a silvery or ashy appearance.

HEAD AND APPENDAGES.—Antennal tubercles of moderate size, strongly diverging. Dorsum of head usually with a pair of rounded tubercles located in about same position as in alate, and varying much in size in different individuals. Rostrum reaching hind coxae. Head and appendages armed with generally capitate or spatulate spines which vary much in length but usually are much more prominent than in the alate. Subcircular sensoria irregularly placed on one side of segment III, usually restricted to basal half but sometimes extending beyond the middle. Apical portion of III feebly imbricated, the following segments more definitely so.

THORAX AND APPENDAGES.—Lateral pro- and mesothoracic tubercles varying much in size but apparently always present. Legs much as in the alate, the spines usually somewhat more prominent than in that form.

ABDOMEN AND APPENDAGES.—Lateral tubercles generally better developed than in the alate, often present on all but the last segment. Each side of the dorsum with two rows of wax pores as in the alate. Cornicles much as in the alate, usually slightly shorter than antennal III. Cauda somewhat broader than in alate with the constriction less noticeable.

MEASUREMENTS.—Ten apterous females from three localities were measured. These measurements are summarized in the following tables:

Antennal Measurements (Average of ten individuals)

Locality	III	Sensoria on III	IV	V	VI
Florida	.886	4.9	.546	.504	.139 + .902
North Carolina	1.009	4.7	.733	.622	.167 + 1.040
Pennsylvania	.926	4.8	.657	.564	.170 + 1.011

Other Measurements (Average of ten individuals)

Locality	Width of head	Cornicle			Length of cauda	Hind tibia
		Length	Width at bulge	Width of reticulated area		
Florida	.481	.766	.082	.043	.333	1.864
North Carolina	.537	.935	.100	.054	.422	2.275
Pennsylvania	.504	.848	.095	.047	.411	2.103

Antennal Measurements (Range in ten individuals)

Locality	III	Sensoria on III	IV	V	VI
Florida	.799– .997	2–9	.466–.666	.444–.577	.133–.155 +.822– .955
North Carolina	.866–1.133	2–7	.599–.888	.511–.733	.155–.177 +.911–1.132
Pennsylvania	.799–1.088	3–8	.577–.755	.511–.666	.155–.177 +.888–1.088

Other Measurements (Range in ten individuals)

Locality	Width of head	Cornicle			Length of cauda	Hind tibia
		Length	Width at bulge	Width of reticulated area		
Florida	.466–.499	.688– .844	.079–.092	.039–.046	.288–.399	1.688–2.111
North Carolina	.511–.577	.866–1.066	.092–.112	.046–.059	.377–.466	2.177–2.422
Pennsylvania	.466–.533	.733– .955	.086–.111	.046–.053	.355–.466	1.911–2.352

HOST PLANTS.—This aphid has been taken on rhododendron, mountain laurel and wild azalea. It feeds upon the tender leaves and stems of the growing tips as well as upon the pedicels of the blossoms and later, on the seed capsules. Ordinarily this insect is only moderately gregarious and is found in small colonies of a few individuals. However, Clyde F. Smith reports (personal correspondence) that he has seen it very abundant at times and that the colonies then appeared to be joining.

DISTRIBUTION.—Florida, N. Carolina, Penn. and Tenn.

TYPES.—The material used in this study consisted of 216 microscope slides bearing 282 alate viviparous females, 212 apterous viviparous females, and a number of immature specimens. An alate female and an apterious female (mounted on one slide) taken by the writers on *Rhododendron maximum* L. at Cashiers, North Carolina, August 22, 1941, are designated as

holotype and morphotype respectively. All of the remaining specimens are considered and designated as paratypes. The collection records of the paratypes are as follows: Unicoi Co., Tenn., Limestone Cove, June 7, 1919, *Rhododrendron maximum,* (Geo. G. Ainslie), A. 1570; same locality, date and collector, *Kalmia latifolia,* A. 1571 (an alate of *Amphorophora kalmiaflora* n. sp. also mounted on this slide); Blount Co., Tenn., May 27, 1921, leaves of *Rhododendron maximum,* (Geo. G. Ainslie), A. 1862; White Haven, Pa., Aug. 17, 1922, *Rhododendron maximum,* (McCubbin and Stover); Monada Gap, Pa., May 23, 1926, on *Azalea,* (T. L. Guyton); "Bear Meadow", Pa., Aug. 6, 1927, *Rhododendron,* (T. L. Guyton); Gainesville, Fla., Hogtown Creek (west of Golf Course), 4/23/1936, *Azalea canescens* Mich., F-1365-36, (A.N.T.); same locality, host, and collector, 4/16/1937, F-1512-37; 4/5/1938, F-1612-38; Marianna, Fla., Blue Springs Run, 4/23/1938, *Azalea canescens,* F-1629-38, (A.N.T.); Pocono Pine, Pa., Aug. 14, 1939, on *Rhododendron,* (L. Blevins); Gainesville, Fla., Hogtown Creek, 4/11/1940, *Azalea canescens,* F-1879-40, (A.N.T); High Springs, Fla., 5/1/1940, *Azalea canescens,* F-1930-40, (A.N.T.); Blowing Rock, N. C., June 12, 1940, white rhododendron, (C. F. Smith); Sparta, N. C., 6/6/1941, *Rhododendron maximum* L., N. C. 41-108, (C. F. Smith); Park Way, Cumberland Park, N. C., 7/1/1941, white rhododendron, N. C. 41-132, (C.F.S.); Mt. Mitchell, N. C., 7/2/1941 (Camp Alice) purple rhododendron, N. C. 41-148 & 149, (C.F.S.); Park Way, N. C., Deep Creek Gap, 7/2/1941, flame azalea, N. C. 41-155, (C.F.S.); Blowing Rock, N. C., 7/30/1941, Rhododendron, N. C. 41-176, (C.F.S.); Cashiers, N. C., Aug. 17 and 18, 1941, *Azalea viscosa* L., (J.O.P.); Sunburst, N. C., Aug. 19, 1941, *Rhododendron maximum,* (P. & T.); Cashiers, N. C., 8/20/1941, *Kalmia latifolia* L., (P. & T.); Cashiers, N. C., Chimney Top Mountain, Aug. 21, 1941, *Azalea viscosa,* (P. & T.); Cashiers, N. C., 8/22/1941, *Rhododendron maximum* L., (P. & T.); State College, Pa., (Shingletown Gap), Aug. 30, 1941, *Rhododendron maximum,* No. 100, (J.O.P.); Pleasant Gap, Pa., May 24, 1942, No. 161, Wild Pink Azalea (probably *A. nudiflora* L.), (J.O.P.); State College, Pa., (Camp 62), June 14, 1942, *Kalmia latifolia* L., (J.O.P.); State College, Pa., June 21, 1942, (Bear Meadow), *Rhododendron maximum,* No. 104, (J.O.P.); Cooks Forest, Pa., June 26, 1942, *Rhododendron maximum,* (J.O.P.); Bottom, N. C., June 11, 1943, white rhododendron, (C.F.S.); Park Way, Cumberland Park, N. C.,

June 11, 1943, white rhododendron, (C.F.S.) ; Gainesville, Fla., Hogtown Creek, (west of Golf Course) , 3/9/1944, *Azalea canescens*, F-2431-44, (A.N.T.).

The holotype, morphotype, and a number of paratype specimens, deposited in the U. S. National Museum (Cat. No. 56945) ; the remaining paratype material in the collection of the Entomology Department, Florida Agri. Exp. Sta. and in the personal collections of Clyde F. Smith, T. L. Guyton, and the writers.

TYPE LOCALITY.—Cashiers, North Carolina.

TAXONOMY.—Four other species of *Amphorophora* are known to feed on the same group of host plants as *A. rhokalaza.* Certain morphological features readily serve to separate them. *A. rhododendronia* Mason differs in having much more prominent antennal tubercles, the antennae and cornicles light colored except at their apices, and the cornicles more slender, especially below the bulge. *A. mitchelli* Mason is easily separated as it has sensoria on III, IV, and V, whereas secondary sensoria are restricted to III in this species. In *A. azaleae* Mason, the tips of the antennal segments and all of VI are darker, while in this species III is the darkest segment and the segments are not darkened at the tip. The spines on the head and the antennal hairs are very small and inconspicuous in *azaleae,* but much more prominent and often capitate in this species. The sensoria arranged in a single row and the very minute antennal hairs, at once, separate, *A. kalmiaflora* n. sp., described below, from *rhokalaza.*

It has been indicated that much variation is found in *A. rhokalaza.* This is particularly noticeable in the spines on the head and antennae, in the dorsal tubercles of the head, and in the lateral tubercles of the thorax and abdomen. A few carefully selected specimens from the many that are at hand, could easily be separated into what would appear to be three or four perfectly good species. However, when the entire collection is studied it is found that there is a gradual variation from one form to another and one can only conclude that all belong to the same species.

AMPHOROPHORA KALMIAFLORA new species
Alate Viviparous Female Figs. 13, 15, 18 and 20

COLOR.—Definite observations have not been made on the coloration of fresh specimens of this species but it probably

is some shade of brown, with dark brown or black appendages. In cleared specimens the head and thorax are medium brown, the abdomen dusky to light brown. The appendages are dark brown to nearly black, except for the basal halves of the femora, a small basal portion of antennal segment III, and the extreme base of the cornicles, which are light yellowish-brown.

HEAD AND APPENDAGES.—Antennal tubercles moderately prominent, diverging, their inner margins strongly curved. Ocelli of medium size, ocular tubercles prominent. A pair of slightly elevated, rounded tubercles usually present on the dorsum of the head. In some individuals these are greatly reduced in size and in some cases they appear to be entirely lacking. Dorsum of head with eight fairly prominent spines arranged in two transverse rows. The dorsal tubercles when present, are located just behind the median spines of the posterior row. In most individuals the dorsal surface of the head is slightly rugose. First antennal segment large, its inner margin somewhat gibbous. Third segment with an irregular row of 12 to 19 subcircular, flat or slightly sunken sensoria. Segments III to VI definitely imbricated. Anterior part of head and first two antennal segments are armed with fairly prominent, slightly curved, pointed hairs. Segments III to VI with very short and inconspicuous pointed hairs, which are strongly reclining. Rostrum rather short, scarcely reaching the middle coxae.

THORAX AND APPENDAGES.—Prothorax rugose, with small, rounded lateral tubercles, anterior margin of mesothorax with a large, irregular tubercle on each side. Wings hyaline, venation normal, legs armed with tapering, pointed, strongly reclining spines, those on the tibiae being slightly shorter than the diameter of the segment. Femora of all pairs of legs with a rounded tubercle beneath, near the base.

ABDOMEN AND APPENDAGES.—Abdomen with very minute lateral tubercles or with these structures entirely absent. Cornicles slightly shorter than antennal segment III, moderately swollen, the apical portion constricted and definitely and coarsely reticulate. Cauda about half as long as cornicles, slightly constricted near the middle, definitely imbricated, the lateral margins appearing strongly serrate, with three pairs of curved laterial hairs and a subapical dorsal hair.

MEASUREMENTS.—Various structures of ten alate females were measured. These measurements are given in the following tables:

Antennal Measurements

Number	III	Sensoria on III	IV	V	VI
1	.711	17	.533	.577	.155 + .933
2	.955	19	.688	.711	.177 + 1.066
3	.755	19	.599	.577	.177 + .977
4	.866	17	.644	.644	.177 + 1.022
5	.822	13	.622	.599	.188 + .977
6	.822	16	.644	.644	.177 + 1.000
7	.799	13	.622	.599	.177 + 1.000
8	.844	17	.644	.666	.177 + .955
9	.888	12	.644	.599	.177 + 1.044
10	.933	17	.688	.599	.177 + 1.022
Average	.839	16	.633	.623	.176 + 1.000

Other Measurements

Number	Width of head	Cornicle			Length of cauda	Hind tibia
		Length	Width at bulge	Width of reticulated area		
1	.466	.599	.073	.046	.266	1.733
2	.533	.777	.086	.046	.344	2.222
3	.488	.711	.073	.040	.299	1.844
4	.488	.755	.086	.046	.311	2.155
5	.488	.711	.073	.040	.311	1.955
6	?	.733	.066	.046	.311	1.844
7	.466	.733	.073	.040	.288	2.000
8	.488	.733	.079	.046	.333	2.000
9	.488	.733	.079	.046	.311	2.044
10	.488	.822	.079	.040	.355	2.177
Average	.488	.731	.079	.044	.313	1.997

Apterous Viviparous Female, Figs. 14, 16, 17, 19 and 21.

COLOR.—The coloration apparently is similar to that of the alate female.

HEAD AND APPENDAGES.—Antennal tubercles prominent, diverging, their inner margins strongly curved. Dorsum of head and the antennal tubercles rugose. A pair of rounded tubercles usually present on the posterior half of the head in the same relative position as in the alate female. These vary greatly in size and in a few cases are entirely lacking. Eyes with large ocular tubercles. First antennal segment large, the inner side somewhat gibbous. Third segment with a single row of 2 to 5 subcircular sensoria on the basal portion. All the segments show imbrications though they are rather faint on the basal ones. Head and first two antennal segments armed with fairly prominent, slightly curved, pointed spines. Segments III to VI

with inconspicuous, pointed, strongly reclining spines. Rostrum reaching nearly or quite to the hind coxae.

THORAX AND APPENDAGES.—Prothorax with a pair of raised, somewhat irregular, lateral tubercles which vary greatly in size. Mesothorax with a pair of much larger and more uneven tubercles on the anterior margin. Femora with a raised tubercle beneath, near the base, these being less prominent than in the alate. The entire surface of the thorax slightly rugose.

ABDOMEN AND APPENDAGES.—Lateral tubercles very minute or entirely lacking. Cornicles as in the alate female. Cauda much as in the alate except that it is somewhat broader, with the middle construction less evident.

MEASUREMENTS.—The following tables give the measurements of various body structures of ten apterous females.

Antennal Measurements

Number	III	Sensoria on III	IV	V	VI
1	.755	5	.533	.533	.166 + .911
2	.711	2	.577	.533	.166 + .888
3	.844	3	.666	.622	.177 + .933
4	.866	3	.666	.644	.177 + .955
5	.711	2	.488	.511	.155 + .888
6	.733	3	.511	.488	.155 + .777
7	.799	4	.533	.555	.177 + .911
8	.777	4	.511	.511	.166 + .911
9	.799	3	.622	.622	.188 + .933
10	.755	2	.577	.622	.177 + .888
Average	.775	3.1	.563	.564	.170 + .899

Other Measurements

Number	Width of head	Cornicle			Length of cauda	Hind tibia
		Length	Width at bulge	Width of reticulated area		
1	.488	.644	.059	.040	.311	1.688
2	.466	.688	.079	.046	.333	1.822
3	.488	.733	.066	.046	.355	2.044
4	.488	.822	.079	.046	.377	2.111
5	.444	.577	.066	.040	?	1.555
6	.466	.666	.059	.040	.311	1.666
7	.466	.733	.079	.046	.377	1.777
8	.466	.666	.072	.040	.311	1.799
9	.499	.755	.079	.046	.388	1.888
10	.488	.688	.079	.046	.355	1.822
Average	.476	.697	.072	.044	.346	1.817

HOST PLANT.—*Kalmia latifolia* L.

DISTRIBUTION.—Pennsylvania and Tennessee.

TYPES.—Holotype alate viviparous female and apterous viviparous female (on same slide), State College, Pennsylvania, (Camp 62), June 14, 1942, on *Kalmia latifolia* L., (J. O. Pepper), deposited in the U. S. National Museum (Cat. No. 56946). Seventeen slides bearing 14 alate and 14 apterious viviparous females, same collection data as above, and one alate viviparous female (on a slide with specimens of *A. rhokalaza,* Unicoi Co., Tennessee, Limestone Cove, June 7, 1919, *Kalmia latifolia,* (Geo. G. Ainslie) have been designated as paratypes. Paratype material in the U. S. National Museum and in the personal collections of Clyde F. Smith and the writers.

TYPE LOCALITY.—State College, Pennsylvania.

TAXONOMY.—Four other species of *Amphorophora* have been taken from the mountain laurel. They can readily be separated from this species on morphological characters. The apterous female in this species differs from the same form of *A. azaleae* Mason, in that antennal segments III to VI are uniformly colored and not darker at the tips and the spines on the head are rather conspicuous. The alate female differs from the alate of *A. mitchelli* Mason, in that the antennae are not tuberculate, secondary sensoria are confined to segment III, and the antennal hairs are very inconspicuous. The apterous female of this species differs from the same form in *A. rhododendronia* Mason, in having very inconspicuous, pointed antennal hairs, and the antennal segments rather uniformly dark brown. Some differences between this species and *A. rhokalaza* have been mentioned in the discussion of that species.

EXPLANATION OF PLATE I

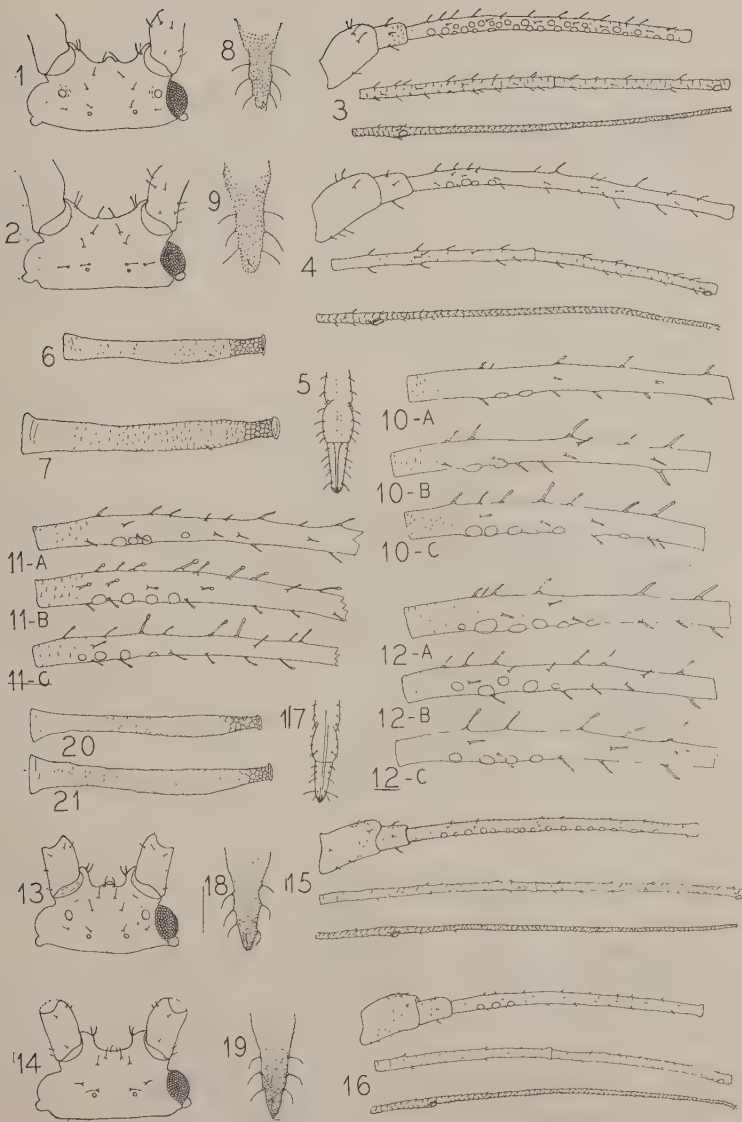
Amphorophora rhokalaza n. sp. Figs. 1-12

1, head, alate viviparous female; 2, head, apterous viviparous female; 3, antenna, alate; 4, antenna, apterous; 5, beak, apterous; 6, cornicle, alate; 7, cornicle, apterous; 8, cauda, alate; 9, cauda, apterous; 10-12, show some variations in hairs on basal half of antennal III in apterous female; 10-A, B, C, from azalea, Florida; 11-A, B, C, from rhododendron, North Carolina; 12-A, B, C, from rhododendron, Pennsylvania.

Amphorophora kalmiaflora n. sp. Figs. 13-21

13, head, alate viviparous female; 14, head, apterous viviparous female; 15, antenna, alate; 16, antenna, apterous; 17, beak apterous; 18, cauda, alate; 19, cauda, apterous; 20, cornicle, alate; 21, cornicle, apterous. Figs. 10, 11 and 12 are 75 X, all others are 45 X.

PLATE I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The
FLORIDA ENTOMOLOGIST

Official Organ of the Florida Entomological Society
Gainesville, Florida

VOL. XXVII JULY, 1944 No. 2

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Issued once every three months. Free to all members of the Society.

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MAY BEETLES OF GEORGIA

A member of our society and formerly of the faculty of the University, Prof. P. W. Fattig, has written a bulletin (Bulletin No. 2, Emory University Museum) on the species of genus Phyllophaga of Georgia, which will be of much interest and value to the entomologists in Florida. Professor Fattig has spent 15 years in this study, during which time he has collected 18,000 specimens of 70 species of Phyllophaga. This compares with 31 species of the genus recorded for South Carolina; 36 from Kentucky; 41 from North Carolina; and 49 from Mississippi.

He reports 27 species from Thomasville. Since this is only a few miles from the state line, probably all of them will be found in Florida as well. Professor Fattig also has lists of the parasites, predators and host plants of the May beetles. —Ed.

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NOTES ON DRAGONFLIES IN THE VICINITY OF NEW SMYRNA BEACH, FLORIDA

MIKE WRIGHT [1]

The purpose of this paper is to report on the unusual dragonfly population near New Smyrna Beach, Fla., during the summer of 1943, and especially on the tremendous swarms of one species during July and August of that year. Observations on abundance and distribution of odonates made in this area during June and early July of 1942 are included in an attempt to picture the population present during normal years.

New Smyrna Beach is located in about the middle of the Florida Atlantic Coast some 16 miles south of Daytona Beach. These observations covered the area from the Tomoka River marshes just a few miles north of Daytona Beach to the Oak Hill marshes about 15 miles south of New Smyrna Beach. This region contains large areas of salt marsh, both on the mainland and on the numerous islands formed by Mosquito Lagoon and Indian River (land-locked salt-water lagoons), that are excellent breeding grounds for the salt-marsh mosquitoes (*Aedes sollicitans* (Walk.) and *A. taeniorhynchus* (Wied.). The mainland, just west of the coastal marshes, contains numerous permanent and semipermanent fresh-water habitats capable of breeding dragonflies.

DRAGONFLY POPULATION DURING 1942.—The following is a list of dragonfly species and their relative abundance noted in the coastal areas during June and July, 1942. No species was observed in sufficient numbers to be listed as abundant.

VERY COMMON: *Erythrodiplax berenice* (Drury) and *Tramea carolina* (Linnaeus).

COMMON: *Anax junius* (Drury), *Coryphaeschna ingens* (Rambur), *Libellula auripennis* Burmeister, *Erythemis simplicicollis* (Say), and *Erythrodiplax connada minuscula* (Rambur).

OCCASIONAL: *Celithemis eponina* (Drury), *Libellula vibrans* Fabricius, *Pachydiplax longipennis* (Burmeister), *Cannacria gravida* (Calvert), *Enallagma civile* (Hagen), and *Ischnura ramburii* Selys.

RARE: *Celithemis ornata* (Rambur), *Nehalennia integricollis*

[1] United States Department of Agriculture
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Bureau of Entomology and Plant Quarantine

Calvert, *Ischnura posita* (Hagen), and *Anomalagrion hastatum* (Say).

This is not a long list of species but probably represents the dominant dragonfly fauna of the coastal marshes of this region. These species do not all breed in the salt or brackish areas, in fact, only a few would probably be able to survive constant high salinities. Many of these breed in fresh areas, in the hammocks and on the mainland, which may be located within a few yards of the marshes. Others, such as *Anax, Coryhaeschna,* and *Tramea,* are sturdy fliers and may range many miles from their breeding grounds. Collections during other months in the year will undoubtedly add a number of species to this list, especially those forms that appear only late in the summer and in the fall.

Erythrodiplax berenice was numerous and was usually found only in the salt marsh, although we recorded the presence of a number of individuals in an orange grove located about one-half mile from the nearest marsh. *Tramea carolina* was the most widely distributed and abundant species noted during this period. It was present in all types of habitats, and many individuals were seen perching on electric wires, shrubs, and trees along the various highways. On June 12, 1942, at about 3:30 P. M., in the vicinity of the South Bridge of New Smyrna Beach, a swarm composed of several thousand individuals of *T. carolina* was noted. They were darting about, in a limited area, as if they were catching some small insects as prey. This is the first record of the swarming of *T. carolina* that we know of. On June 11, 1942, large numbers of *Coryphaeschna ingens* were observed swarming along the banks of Mosquito Lagoon at Coronado Beach. The swarm was first noted at 7:30 P. M. and remained in this locale until about 9 P. M. They were feeding on mosquitoes (mainly *Aedes sollicitans*) and gnats which were abundant at that time. The individuals of *Enallagma civile* seen were, surprisingly enough, around ponds out in the salt marsh proper. In several areas the temperature of these ponds (at the time of our investigation) ranged from 90° to 97° F. while salinity varied from a low to a fairly high salt concentration. It is very doubtful if this damselfly breeds in these salt-marsh ponds. Some species, such as *Ischnura ramburii,* have been found breeding in areas having almost twice the salt concentration of sea water (Pearse, 1932). The few individuals of *Nehalennia integricollis* taken were found in the hammocks and never in the marsh proper. They are strictly fresh-water forms.

Dragonflies composed a large and important part of the insect fauna of the marshes, but on no occasion during the 1942 period were they present in the tremendous numbers covering such large areas as was noted during 1943.

DRAGONFLY POPULATION DURING 1943.—From October, 1942, to the latter part of May, 1943, practically no rain fell in the entire area. According to long-time residents, this was the worst drought they had ever encountered in this region. Periodic inspections of fresh-water habitats during the fall and winter showed continuous drying up, and by April almost all were completely devoid of water. As late as May 14, we were told by Mr. W. C. White, of the Volusia County Mosquito Abatement Project, that fresh-water areas known by him to have been permanent bodies of water for some 23 years were now dry. The only areas containing fresh water that we were able to find in the vicinity of New Smyrna were several large, major drainage ditches on the mainland. Even these showed very low water levels, and some were nothing but a series of disconnected pools. A total of 12 species of dragonflies were found along these drainage ditches, but never more than 10 or 12 dragonflies were found in any area. As late as June 16, inspection of fresh-water areas showed all ponds and pools to be thoroughly dry and, in addition, many of the drainage ditches were then dry. One such ditch that had held water constantly was first noted to have begun drying early in May. When inspected several weeks later the water level had so dropped that the only water left within about one-half mile of the ditch investigated was concentrated in a pool some 15 to 20 feet long by several feet wide. This pool contained literally thousands of small fish and minnows, and tadpoles. The area around the pool was covered with dead and dying fish and tadpoles that had been stranded by the receding water. This pool ultimately dried up, causing the extinction of all aquatic life in that section of the ditch. This was typical of the majority of the permanent areas. There were some areas, however, with pools deep enough to retain a small amount of water throughout the drought period. These were few in number and scattered. The whole area became so dry that grass and forest fires were a constant menace.

The salt marshes themselves, when not inundated by tidal action, became extremely dry. Visits to a number of these showed that few individuals and species of dragonflies were

present. *Anax junius, Coryphaeschna ingens, Pachydiplax longipennis,* and *Tramea carolina* were the only species encountered during the period of drought. *T. carolina* was by far the more abundant, but only a few individuals of even this species were encountered in a given locale. We were surprised to note the total absence of *Erythrodiplax berenice* on several survey trips in salt marshes south of New Smyrna Beach. We are unable to account for this, as this species has been found breeding in waters having almost double the salinity of sea water (Pearse, 1932). There were plenty of available breeding areas in the marshes surveyed.

When the rains finally came in June and July, the marshes were flooded, and the fresh-water areas temporary and permanent, were filled. This resulted in one of the most severe outbreaks of pest mosquitoes encountered in this area for a number of years. The catches from light traps in the New Smyrna area, which during the spring had yielded few or no mosquitoes, rose rapidly until by July many of the nightly counts contained over 2,000 pest mosquitoes. These were *Aedes sollicitans* and *A. taeniorhynchus* from the salt marshes and *Psorophora columbiae* (D. & K.) from temporary fresh-water pools. The salt marsh breeding sandfly *Culicoides furens* (Poey) became extremely abundant and annoying at the same time. On several nights in July as much as three-fourths of a pint of these small gnats were taken from a single light trap. This represented thousands of individual sand-flies.

The dragonfly population remained at the same low ebb all during June and the first half of July. At about 7 P. M. on July 16, 1943, a large swarm of dragonflies was noted along the Mosquito Lagoon at New Smyrna Beach. As far as one could see, the sky was literally alive with dragonflies darting about in search of prey. Collections and observations showed the swarms to be almost entirely *Pantala flavescens* (Fabricius), with an occasional individual of *Anax, Coryphaeschna,* or *Tramea.* These four species are very distinct in coloration, size, and flight habits and are easily identified on the wing. Large numbers of sandflies and of mosquitoes (*Aedes taeniorhynchus* and *Psorophora columbiae*) were present and were being captured as food by the odonates. Several of the dragonflies captured showed mosquito fragments in their mandibles. Dragonflies were observed to perch at intervals on the trees and palms and were apparently consuming their prey. Numerous birds of various species

were seen darting in and out of the swarming dragonflies, but no actual capture of dragonflies was observed. Our field notes state that this was the first time during 1943 that over a dozen dragonflies had been seen in any one area. Trips to the Oak Hill marshes on the south and to the Tomoka River marshes over 30 miles to the north showed large numbers of drangflies over the entire area. Trips to points as far as 10 miles inland also disclosed the presence of swarms of odonates. These swarms were composed almost entirely of *Pantela flavescens* and were observed feeding on mosquitoes throughout the area. Our last field note, dated August 1, 1943, states that the swarms were still present. As the writer left the New Smyrna area several days later and did not return, nothing further is known concerning the fate of these swarms.

The data presented show that due to the severe drought these large and continuous swarms of dragonflies could not have bred in the vincity of this area. They would have had to migrate into the area from points at least 10 miles inland (west). In the light of the evidence now available it seems that this migration of the dragonflies into the coastal area was a definite movement for obtaining food. The writer (1944) has shown that swarms of *Anax junius* follow the movements of high populations of dog flies (*Stomoxys calcitrans*) from the inland areas of northwestern Florida to the beaches. This is purely a food migration. It is here suggested that, in the case of *Pantala flavescens*, mosquitoes blown inland by easterly winds served as an attractant and drew the swarms of dragonflies towards the higher concentration of food along the coast.

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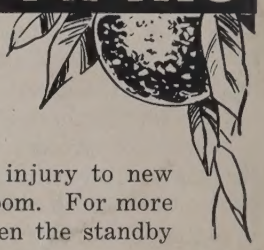

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